Towards a Conceptual Framework for Transdisciplinary Research:

Challenges and Opportunities

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OUTLINE

- ***Facilitating and Constraining Factors***

  Summary of analysis based on case studies of interdisciplinary innovation at the boundaries of the health and social sciences (Rosenfield and Kessel, 2003)

- ***Recent Cases – Back to the Future***

  What's new, what's not? ↔ "The Potential of Transdisciplinary Research …" (Rosenfield, 1992)

- ***What's Missing, What's Needed***

  The concept of heterarchy

- ***Implications and Applications***

  For planning, funding, conduct, and communication of transdisciplinary research . . . and programs preparing such researchers

Facilitating and Constraining Factors

- **Constraining Factors: 'Internal'**
  - Language Barriers between Disciplines
  - Status Barriers between Biomedical and Social Science Disciplines

- **Facilitating Factors: 'Internal'**
  - Personal Characteristics of Investigators (e.g., willingness to work in teams; intellectual curiosity; courage)
  - Investigator Perseverance
  - Serendipitous Encounters with New Ideas and People

Facilitating and Constraining Factors

- **Constraining Factors: 'External'**
  - Institutional Barriers: Time Pressures
  - Tenure Review Process Discourages Team Work
  - Home Departments Discourage Cross-Departmental/Faculty Collaboration
  - Centers/Institutes Have To Be Self-Supporting (P.I.'s as Fundraisers)
  - Relevant/Appropriate Peer Review Difficult
  - Interdisciplinary Journals Less Prestigious

- **Facilitating Factors: 'External'**
  - Government and Foundation Funding
  - Sustained, Long-Term Funding
  - New Technologies & New Concepts

Four Elements Necessary for Sustainable Success

- Participation of Intellectual Risk-Takers
- Training Programs to Promote and Sustain Interdisciplinary Research
- Supportive Academic Environments at All Levels (President, Provost, Deans, Chairs)
- Sustained Long-Term Funding from Academic Institutions, Foundations and Government
- [This kind of analysis obviously & importantly extended by the NAS/Keck Interdisciplinary Initiative, e.g., emphasis on "drivers" of interdisciplinary research such as societal forces and complexity]

"The Potential . . ." : Programmatic & Scientific Context

- **Foster's (1987) challenge to WHO –**
  - **" . . . far-sighted medical doctors and international health workers began to realize that the effective delivery of health care, especially in cross-cultural settings, involved socio- cultural as well as purely medical factors."**
  - **"Although a good deal of WHO-sponsored research is based on the teamwork concept, involving a variety of medical and behavioral specialists, professional equality within teams is not always evident. Some teamwork research suggests that the role of behavioral sciences has been to carry out the instructions of their medical colleagues, to gather data according to research designs in which their input has been minimal."**

"The Potential . . ." Context (cont'd)

- **Tropical Disease Research (TDR) Program's Social and Economic Research (SER) Steering Committee**
  - **Organizational Advantage -- Comprised primarily of social scientists ad full–fledged part of larger biomedical program.**
  - **But faced usual constraints (Foster) and more problems of partnership and acceptability within WHO (e.g., malariologists).**
  - **Other disease and vector control specialists felt that adding social scientists to team wasted time and money – 'Social scientists wanted to ask too many irrelevant questions'.**
  - **Yet pioneering social scientists in developing countries engaged with counterparts in health sciences & health ministries at intellectual and applied levels and accepted the challenge of the TDR social science program. In the process developed projects results that won over many skeptics inside WHO, in health ministries, & academic social science departments.**

"The Potential . . ." Context (cont'd)

- Despite success, concern that process of cross-disciplinary work not intellectually examined; terms often used casually without attention to the fundamental question:
- Recognizing that health is integral product of social, cultural & political conditions as well as biological & ecological factors, how can collaboration across disciplines lead to new ways of framing, understanding, & addressing human health issues?
- Rosenfield aimed to explore meaning of terms 'multidisciplinary' and 'interdisciplinary' research increasingly being used by medical personnel and others.
- Concluded that input of different disciplines was being sought, but not creative ways to blend disciplines to yield deeper understanding of nature of the problem and, thereby, solution that would have more staying power, be more acceptable in the population at risk, and more cost-effective in the long run.

"The Potential . . ." Context (cont'd)

- **Intersectoral Initiatives**
  - **Analysis & associated advocacy of "transdisciplinarity" were also prompted by parallel set of conversations at WHO -- Work on intersectoral actions for health under leadership of Aleya el-Bindari Hammad -- In 1986 brought together researchers & decision makers from agriculture, water, population, economics, and policymaking.**
  - **Overall goal of the group -- Understand more fully the complexity of health problems at local, community & national levels & identify more multi-dimensional, intersectoral solutions that might be more sustainable (using same indicators of effectiveness of health and development programs, *viz.*, improvement of marginal populations).**
  - **What became of Hammad effort? Short answer -- Because of their complexity and challenging nature, group's ideas never fully accepted in programmatic policy and practice. More generally, in late-1980s/early-1990s, welcoming 'receptor sites' for concepts such as intersectorality and transciplinarity were largely absent in the health and medical research field. But . . .**

Exceptions: Then and Now

- In 1970 Anthony Judge used "trans-disciplinary" in writing about different forms of knowledge. Through '70s & '80s, several scholars in Europe & U.S. -- primarily from ecology, computer science & complexity analysis -- began to consider meaning and use of "transdisciplinarity".
- In the early '90s, given increasing recognition of complexity associated with globalization, social science community in Europe began to consider concept of transdisciplinarity. Though dominated by sociologists, critical mass across a range of social science fields emerged. In '94 First World Congress of Transdisciplinarity was held in Portugal, charter prepared and endorsed. Since then domain has burgeoned -- prizes, an Institute in Switzerland, a journal (published in Albany, NY), and active Web presence.
- But most recent report of European Science Foundation, despite mention of multi- & inter-disciplinary research, contains no reference to transdisciplinarity in either social or health sciences section
- Suggests that, in mainstream European scientific circles, concept has not received significant attention. U.S. and Canada? Elsewhere?

Exceptions Then

- In the developing world in the '90s work across the health & social sciences was taking hold. Spurred primarily by innovations at the University of Newcastle (Australia) under the leadership of Glenn Albrecht and Nick Higginbotham, social & health scientists in developing countries began to extend conceptual & empirical work.
- Albrecht and Higginbotham took up the challenge of institutionalizing the concepts underpinning transdisplinarity & developed the first curriculum in this area (still in active use).
- In 2001 Higginbotham & colleagues published a book summarizing case studies undertaken in the '90s. *Applying Health Social Science: Best Practice in the* D*eveloping World* is a watershed publication, a rare collection of detailed analyses of health & social science collaboration in several regions -- Asia and the Pacific, Africa, & Latin America.

Exceptions Then (cont'd)

- Several shared & familiar themes across the regions and cases.

  E.g. -- "Despite the growth in the number of African scholars in health social science, their contributions to research, policy initiatives, health-care promotion and medical education are still constrained. A gulf between social and biomedical scientists remains because African biomedical scientists only grudgingly accommodate social scientists working within medical school. . . "

- Most germane here, Albrecht & Higgenbotham advocate methodological contributions to help implement transdisciplinary approaches, since most of the case studies "do not offer much of a perspective on the interface between the social science members and other members of the team. . . .The nature of the collaboration between team members was either multidisciplinary or interdisciplinary." Only the work in Indonesia progressed to a transdisciplinary approach, where "members arrived at a shared conceptual framework that drew together and transcended disciplinary-specific theories, concepts and approaches to address the problem."

Exceptions Then and Now

- This country in the ’90s? Among others, the MacArthur Foundation’s path-breaking use of networks to promote new science was highly instrumental in bringing about connections across disparate disciplines. And there was, and is, OBSSR . . . Which, it so happens, funded the SSRC Working Group that produced the Kessel-Rosenfield-Anderson volume of case studies.

- In the three years since that was published, the boundary-crossing trend has continued, even strengthened. E.g., preparing for a second edition, we asked case study authors to provide postscripts updating research findings and the situation with regard to interdisciplinary collaboration. What has emerged -- Each of the teams has been able to stay together & even expand the focus around the core of their research efforts, despite occasional changes in leadership & membership.

'Exceptions' Now

- One reason for such continuity -- Sustained funding from both foundations & the government here & in England, as well as from researchers' home universities. Complementary explanation – Like tobacco-oriented work, continued funding comes about because of the intellectual firepower teams are directing at understanding problems, along with the significance of their findings & possible solutions.

- On funding -- Olshansky & Carnes emphasize the importance of the NIH Road Map as a vehicle for encouraging & supporting interdisciplinary research undertaken by both individuals & centers. Note particularly the P20 mechanism as a way to encourage research consortia in the demographic and population sciences.

- They also mention the fact that multiple investigators are now recognized & accepted on NIH projects. One byproduct -- There will be fewer "penalties on imposed by promotion and tenure committees on individuals who participate in collaborative activities."

'Exceptions' Now (cont'd)

- Ryff & Singer also observe that obstacles to conducting cross-boundary work, especially those relating to funding and peer-review publications, appear to be weakening. As a significant example, NIA has awarded their team a sizable grant to study the biological, psychological & social pathways to positive health. And though Ryff and Singer refer to their work as multidisciplinary, from our perspective their overall frame is at least potentially transdisciplinary in character.

- In a related vein, Seeman: "I am also encouraged by the many signs of growth of interest in biopsychosocial research, not the least of which can be seen in the many large, NIH-funded studies that have requested assistance in adding biological assessments to their range of protocols . . . Inclusion of such biological data in these studies will offer expanded opportunities to study, and hopefully come to better understand, the complex relationships between social and psychological experiences, their biological substrates and sequelae and the ultimate impact of these relationships on trajectories of health and well-being across the life course."

'Exceptions' Now (cont'd)

- **Two cases reflect the experiences of a large multimember team based in one center and reaching out to many others. Michael Marmot & colleagues in their studies of aging and the social gradient in the UK; and studies of HIV/ AIDS in San Francisco (and elsewhere) by Margaret Chesney, Tom Coates & their colleagues.**

- **Marmot's case involves a major study on aging that is "both multidisciplinary and interdisciplinary . . . [It has] major content in economic, health-clinical, biological and health care and its determinants, social participation and cognitive psychology." Led by Marmot, an epidemiologist, the team involves scientists from all the relevant disciplines. That, he notes, is the multidisciplinary aspect of the study, "each discipline working on its own area". But now, after several years of working on the Whitehall studies, they "have a flourishing interdisciplinary environment."**

'Exceptions' Now (cont'd)

- **Chesney et al's Center for AIDS Prevention Studies (CAPS) has undergone changes in scientific leadership and staff, but collegiality and related productivity have remained constant across the generations. Relevant here – They also note approvingly the importance of the flexibility NIH has now established with regard to the P30 mechanism.**

- **And again, even as Chesney et al. speak of themselves as doing "multidisciplinary research", in our view the potential for their Center to become truly transdisciplinary is embedded in all their projects and successes.**

- **More generally, in a manner perhaps similar to tobacco research, the field of HIV/AIDS research appears to be a perfect focus for transdisciplinary attention. Because of its productivity and success, both domestically & internationally, CAPS could serve as a prototype by helping to promote new multi-dimensional, integrative thinking in the approach to AIDS research. Which brings us, finally, to . . .**

What's Missing, What's Needed

- What kind of conceptual framework might help shape emerging & evolving explorations of health across diverse disciplinary boundaries and in the direction of authentic transdisciplinarity? As noteworthy examples, Anderson (in 1998) and McKinlay (in 2000) have stressed the importance of multi-level analysis in organizing research on health problems, analysis moving in a hierarchical manner from molecule to society, or vice-versa. And Albrecht and Higginbotham introduce a different kind of hierarchy, the social-cultural hierarchy related to values, practices and cultural context (notions, it's worth noting, beyond a *soupćon* of the social-psychological).

- They also have also encouraged health social scientists to adopt complexity theory as an analytical framework --"Complexity theory . . . can fully occupy 'transdisciplinary space', enabling biomedical insights to be combined with those from ethnographic fieldwork, and epidemiological data with critical analyses from political economy . . . "

What's Needed -- Heterarchy

- **Yet in our view something is missing in this partitioning of levels or layers, albeit with provision of movement between them. As we suggested in our original commentary (inspired by Cacioppo's writings and his research with Berntson):**

- **"Heterarchy . . . could serve as a heuristically powerful metaphor for framing both our scientific thinking and organizational practice in the realm of human and social problems that are patently complex, multidimensional, and interactive (over time and space).. . . Not surprisingly, the term was first used by one of the pioneers of contemporary cognitive neuroscience, Warren McCulloch (1945), to describe forms of brain organization which, though structured, are not hierarchical."**

- **Which led to this from Crumley:**

Heterarchy (cont'd)

- "Heterarchy may be defined as the relation of elements to one another when they are unranked or when they possess the potential for being ranked in a number of different ways. . . . Many structures, both biological and social, are not organized hierarchically. . . Hierarchy -- inasmuch as it is often a reductionist metaphor for order -- has disproportionately influenced theory building in both social and natural scientific contexts. . . . This conflation of hierarchy with order makes it difficult to imagine, much less recognize, patterns of relations that are complex but not hierarchical."

- Several years later, we have the impression, first, that appreciation of the breadth and depth of McCulloch's contributions has been spreading; and second, that the notion of heterarchy is being explored in an increasing variety of areas, ranging from domains close to McCulloch's original scientific interests to areas further afield, such as evolution, ecology, and socio-political development, and still others that circle back to his passion for philosophy in the form of what he called "experimental epistemology". So . . .

Heterarchy (cont'd)

- We are increasingly convinced that viewing various facets of the scientific landscape through a heterarchical lens has significant heuristic power. In one direction, there are implications for how inquiry is organized and institutionalized, with emphasis on "a network of elements [read – disciplines] sharing common goals in which each element shares the same 'horizontal' position of power and authority, each having an equal vote. . . Socially, a heterarchy distributes privilege and decision-making among participants . . . In an organizational context, [heterarchy's] beauty is the way in which it permits the legitimate valuation of multiple skills, types of knowledge or working styles without privileging one over the other."

- [This quote comes from the *Wikipedia* entry for "heterarchy". Appropriately so, given another part of that entry – "A heterarchical structure processes more information more effectively than hierarchical design. An example of the potential effectiveness of heterarchy would be the rapid growth of the heterarchical Wikipedia project in comparison with the failed growth of the Nupedia project. Heterarchy increasingly trumps hierarchy as complexity and rate of change increase."]

Heterarchy (cont'd)

- In a separate yet complementary direction, as the work of Cacioppo & Berntson, Ryff & Singer, and others continues to instantiate and, indeed, prove, understanding the rich complexities of human life [read – health] is most likely to emerge via work that recognizes and embraces, in theory and research practice, multiple levels of analysis and the associated principles of multiple, nonadditive, and reciprocal determinism.
  - "A process or event at one level of organization may have antecedents and determinants both within and across organizational levels, as encapsulated in what has been termed the *principle of multiple determinism.*
  - "Although the whole may not be greater than the sum of its parts, the properties of its parts may only, or more readily, be knowable by the properties of the whole. This has been articulated as the *principle of nonadditive determinism.*
  - "A final principle that characterizes the relations among heterarchical levels of organization is the *principle of reciprocal determinism*, which asserts that there can be mutual influences among higher and lower levels of organization in the determination of behavior."

Implications and Next Steps

- **Questions and Provocations:**

  - ***What's the link between heterarchy and transdisciplinarity?***

If transdiciplinarity is the approach for combining-cum-transcending disciplines in creative, integrative, 'emergent' ways,

heterarchy is both a heuristic metaphor and a potential analytic framework for operationalization such an approach . . . [*Discuss!]*

Questions and Provocations (cont'd)

- ***How to co-ordinate emerging transdisciplinary-heterarchical efforts?***

Hartzog's Panarchy as a meta-frame, as a means of networking networks:

"The emerging complexity of our social and political structures, composed of many interacting agents, combined with the increasing importance of network forms of organization, enabled by technologies that increase connectivity, propels the world system towards a transformation that culminates in a global political environment that is made up of a diversity of spheres of governance, the whole of which is called panarchy. To clarify, global linkages between individuals and groups create transnational networks consisting of shared norms and goals . . . Panarchy is governance as 'complex adaptive systems' of anarchical networks that relies on diversity and resists hierarchy in order to function and adapt." [*Discuss!*]

Questions and Provocations (cont'd)

- What norms & goals . . . and ethics to guide the science and art of team science? Sidney Brenner →

"I wonder what medicine will be like in 2053, the 100th anniversary of the discovery of the DNA structure, or even in 2020 (the year of good vision). Many people base their lives on the proposition that they can do what they like to their bodies because medical science will come and save them with a pill. Perhaps the prime value of our work to society will be the creation of a new public health paradigm in which we are all taught how to look after our somatic selves; those who have a genetic background that makes them especially liable to one of the diseases of our civilization will have to learn how to take extra care. . . Should society exercise greater control over what people eat? Are solutions in the large public domain a threat to what people consider their individual freedoms? I think that these questions require more thought than worrying about people trying to clone themselves . . .

Questions and Provocations (cont'd)

" There is also another dimension to these questions: Not everybody in the world today can enjoy the luxury of killing themselves by overnutrition; we have many people dying of starvation . . .

" I was asked by a student what ethical standards should be adopted by life scientists. I could immediately think of two prescriptions. The first, common to all scientists, is to tell the truth. The second is to stand up for all humanity." [*Discuss!]*